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Liebig, Natural laws of Husbandry, English Edition, by Blyth, 1863.

THE fundamental basis of the theories of the school of agricultural chemists who follow Liebig, regarding the science of growing corn, is the so-called mineral theory. Its propositions may be shortly stated as follow:—

1. Plants obtain solely from the soil in which they grow the fixed elements of their food, as the earthy phosphates, silica.

2. The supply of these in that part of the soil reached by the roots is limited.

3. If corn crops are continually consumed off the soil, exhaustion inevitably results.

4. The resources at command of the farmer to counteract such exhaustion are—(*a*) the direct replacing of the necessary elements by manure; (*b*) deep ploughing, whereby soil in fact virgin is made accessible to plants; (*c*) rotation of crops (or fallows), whereby time is given for chemical or other action to restore to the upper stratum of vegetable humus fresh supplies from below of the earthy phosphates, &c.

These principles underlie the practice of English corn-farming. The tenant is usually strictly bound not to take more than a stated number of white corps from the land, not exceeding for instance on good land more than two in four years. He is only allowed to sell straw on condition of applying a compensating quantity of extraneous manure. He is allowed perhaps to take an extra corn crop if he feeds a certain number of sheep with artificial (cake) food on the land: the whole scheme being founded on the principle that the tenant "shall not take out more than he puts in." This theory is so strictly forced on their tenants by most English landlords, that all attempt at experiment, and hence at improvement, is precluded. In the eyes of the vulgar English landlord, agriculture has reached its tether.

Baron Liebig's later writings have been elaborations of these views. He has added many complications, such as that plants cannot assimilate the mineral elements in a crude form, and that many manures operate by producing nascent physical

combination of elements previously in the soil; that the exhaustion of soils often arises from the exhaustion of the sub-soil. Omitting these refinements, Liebig proclaims broadly the principle that every soil must be exhausted by consuming continually corn-crops off it, unless the mineral elements carried away by the corn are identically replaced by manure.

These may called the principles of the fashionable agricultural chemist; but even among chemists there is a respectable minority who doubt if this mineral theory contains more than a portion (at most) of the truth. They doubt if the elements known to chemists are ultimate elements; they do not doubt but that the vital force in plants can effect resolutions which Liebig cannot: they therefore think it quite possible that a growing plant may supply itself with phosphorus and silica out of air and water in which Liebig can find none. They also point out to Liebig the undiminished fertility of Rhenish Bavaria since the time of Charlemagne; and Liebig in his reply admits that the process of exhaustion may, under certain circumstances, be a very protracted one. The English advanced practical farmers have also steadily rejected the mineral theory; they have rather worked out for themselves a form of the struggle-for-existence theory; they assert that on a tolerably retentive, even poorish, clay they can grow "corn for ever" if they can only keep the land clean, especially from grasses and sedges, which, as allied plants, compete most closely with corn. They oppose Liebig at every point; they talk of ploughing as a necessary evil only to be resorted to in extremity, and they till mainly by the cultivator, the scarifier, and the hoe.

Bengal offers too striking an apparent exception to all Baron Liebig's theory to be overlooked. The same fields, without any rotation of crops, without any manure, without ever getting a deep ploughing, have grown corn unfailingly for probably two thousand years at least; and much of such land has produced two crops annually. Liebig meets this obvious difficulty in the following words:—

"We know most positively that the corn-fields in the valley "of the Nile and the basin of the Ganges remain permanently "fruitful, simply because nature has taken upon herself to "restore the last condition of productiveness to the soil in the "mud deposited by the inundation of these rivers which gra-"dually raise the land.

"All the fields that are not reached by the river lose their "productiveness unless manured. In Egypt the amount of the "crops to be expected is calculated from the height of the "water of the Nile; and in the East Indies a famine is the "inevitable consequence whenever there happens to be no "inundation."

Baron Liebig never has seen Bengal, and this passage appears to us so very wide of the mark that we should not have selected it for particular comment had we not found to our surprise that it is the theory by which many English residents in Bengal explain to their own private satisfaction the fact that the Bengali ryot can grow a corn-crop, frequently two, every year, while the Scotch farmer can only get a corn-crop every other year. As the question lies at the very root of the subject, it ought to be cleared if possible.

As a first objection to Baron Liebig there stands the fact that the transplanted rice *(rowa vide infra)*, even in South-East Bengal, is grown on *fields that are never inundated by river-water.* The rowa in Mymensingh, in great part of Comilla, Noakhali, Chittagong, and Dacca, depends entirely on rain-water. Liebig says truly that a deficiency in water is followed by famine in Bengal, but we maintain that the cause of the famine is the deficiency in the water and not in the earthy phosphates held in the water and deposited by it over the fields. The area of land adjoining muddy rivers does not constitute a large portion of the total area even of East Bengal; and when you are hardly fifty yards from the river among the rice you find yourself in still clear water. In short, water, however muddy, after flowing but a few yards through standing rice, loses its velocity and deposits the mud in solution there. The banks of the rivers are, as usually in deltas, the most elevated spots. The body of water is doubtless always moving south, but in a rice-field, in the height of the rains, there is no perceptible current. That water moving so exceedingly slowly should deposit anything is inconceivable. We feel no doubt but that an excellent crop of rice *(amon)* might be grown if it were for experiment watered with distilled water: provided enough distilled water were given. It might be objected to this argument that the rivers of East Bengal are continually shifting, and that the whole country has been river inundated within 2,000 years, and much of it within 200 years. This is partly true, but the country left, when a river shifts its path, is a mass of sandy churs. No land is so bad for *rowa;* and it is only after many hundred years, and the growth of heavy vegetation on it, that such lands appear to become stiff enough to make prime rice-land. Probably within not very remote times a great part of Furreedpore, Vicrampore, and Manickgunge, has been Ganges inundated, more so perhaps than any other part of East Bengal; and it is exactly these districts that form the sandiest land in this part of the country, and in them hardly any rowa is grown, only the inferior owsh and amon. It will be remarked that Baron Leibig has a suspicion himself concerning the correctness of his theory for Bengal, for he begins: "We know most positively,"—

a phrase suspiciously reminding one of the "it is easy to see" which a French writer on mathematics invariably prefixes to all his ticklish assumptions.

Before proceeding to hazard any competing explanation to Baron Liebig's, it may be convenient to introduce a very short sketch of the practice of growing rice in East Bengal.

The Hindu reckon "several hundred" sorts of rice, adapted for land of different qualities and situations as regards water, and requiring different management; but for our very general purpose we will classify them as three, viz. owsh, amon, and rowa. It will be understood that there are numerous varieties and qualities of each, and also other kinds of rice which are intermediate between owsh and amon or between amon and rowa.

Owsh is the spring-rice sown mostly about April, harvested mostly in July and August. There are varities of owsh sown much earlier (in February) on the churs; there are varieties of owsh sown on land never inundated, and other varieties which from earing to harvest stand in water.

In cultivating for owsh, the following will be a common tilth. In April, just before sowing, as soon as the showers have loosened the soil. whether there has been a cold-weather crop, or whether the land has lain untouched since the December harvest, the ryot ploughs the land across and across, very shallow; but he thoroughly pulverizes the surface. The harrow then draws the weeds to the side of the field, where the more careful cultivator burns them and places the ashes on the land. The owsh is then sown broad-cast, and finally the smoother *(maw-ee)* put over the field. The whole of May and the first-half of June this crop requires most laborious weeding, and during this time the ryots can be seen squatted over the country patiently hand-weeding with a short spud. The showers at this reason cause the weeds to grow very fast, especially the grasses, and many sedges of the genus cyperus; and on the laborious weeding out of these depends the crop.

The varieties of owsh are the lowest classes of rice, and the crop is the least valuable of rice crops. Owsh rarely is the only crop of the year except on churs. Much, however, of the land in Manickgunge and Furreedpore grows no rice except owsh.

Amon is the floating, *i. e.* deep-water, rice. There are endless varieties, and one used in Sylhet will, it is said, keep its head above water if the water rises 18 feet. It may be remarked in passing that rice will not grow under water, and if swamped, it is done for. Amon is sown mostly from April to June, and reaped in November and December. It is sometimes sown simultaneously with owsh, *i. e.* on the same land, or more often sown broad-cast among the owsh after the owsh has undergone

its first weeding. In these cases, the owsh being gathered by sickle, the amon is left growing. Amon is the rice to grow on all flooded lands, and is of course often grown where no owsh is grown before. In these cases the land is prepared as above described for owsh, but usually a month later; and the amon is sown broad-cast on it dry.

Where amon follows owsh, the weeding for the owsh suffices for the amon; in other cases it requires hand-weeding on its own account so long as the field remains dry. But amon is subject to another subsequent pest after the land is inundated in oori or wild rice. The oori, or wild rice, can hardly be distinguished before it flowers, except by a ryot, from many cultivated amons. Oori is sometimes, on the edge of bheels, &c., cultivated for fodder, rarely for corn. The grain of oori is by no means valueless, but oori has the unfortunate peculiarity that the moment the grain is ripe, the oori scatters it: it is hardly possible to harvest it, and for the same reason it is the most permanent weed in amon in East Bengal. All through the early part of the rains the ryots proceed partly in boats, partly up to their necks in water, through their fields of amon to pull up the oori, which they carry in bundles off the land. Oori being so closely allied to, merely a variety of, amon is therefore the worst enemy that amon has. Amon produces rice of the second quality.

Rowa is the autum rice. It is transplanted out about August, harvested in December or January. There are many sorts of rowa with different names, the most important being the fine rowas, which are the highest quality of rice grown in East Bengal. Rowa depends essentially on rain: it is grown on fields either never inundated, or only inundated in August to the depth of a few inches. The land, when in its wettest state is worked with a Bengali harrow into a uniform state of liquid mud to a depth of six inches to a foot, the field being generally surrounded with a low bank of earth. The rowa is then planted in tufts in the liquid mud, having been previously raised in nurseries. The bank round the field prevents the water running away very quickly, and catches all the late showers, and on this allowance of water the rowa comes to harvest; but all the fine sorts are said to require a retentive soil, as if the soil is sandy the water slips away in spite of the bank. Rowa produces, as has been said, the finest kind of rice and the most valuable of all rice-crops, and it has a further enormous advantage—it never requires weeding; it ripens in a very short time after being transplanted out, and when planted out, it is a foot high, so that the weeds cannot get up under it: they are choked. What weeds are seen under rowa are only little flowering short-lived annuals, and do not perceptibly injure the corn. We should guess

that in this watery south-east division, the area of rowa grown is two-thirds that of amon, the crop being far more valuable. In official enquiries it seems unknown or is perhaps confounded under the name of amon, from which it differs in every particular, except that it ripens about the same season, usually a month later. Rent of rowa land is, on the average, double that of amon land. To complete annual rotation of crops, the field remains bare of rice from December to April, and the most general plan is to leave it fallow; but in some districts, as in Vicrampore and Manickgunge, a cold-weather crop is not unfrequent, usually some kind of gram or mustard. It is difficult to get it off in time if owsh is to be sown, and the people in general seem hardly to think its value worth the trouble growing it.

In the above sketch there should have been given some estimate of the quantity of seed-rice employed and of the crops ordinarily obtained; but we have been unable to collect any trustworthy statistics. The only people who seem to be able to give any good information on these points are those directly interested in the produce. Farmers in England have, up to the present time, successfully resisted every attempt to collect agricultural statistics. A further difficulty in Bengal is the total uncertainty regarding all measures of area, the same words, "khanee," "pakee," and "bigha," representing a different area in two adjoining villages; nay, in one and the same village, two zemindars will measure each by his own nul, and the pakee of one will be nearly half as much again as that of the other.

We have some reason to think that the Hindu ryot sows from 1½ to 3 bushels of rice to the acre, which is not large for broadcast sowing; and the six maunds of dhan to the Calcutta bigha is a very fair crop of amon, the rowa crop being much larger, the owsh crop considerably smaller. This will represent perhaps for lands that grow two crops of rice in the year an annual cereal yield by weight per acre equal to that of the wheat-crop in England.

This is a highly successful result: let next be considered certain causes and circumstances which contribute thereto, or which more or less interfere with it.

The Bengali ryot assumes that, if he keeps his owsh or amon clear of weeds, he is sure of a crop. (We omit here the question of water which the Bengali ryot regards as he regards the question of sun.) In this opinion he agrees with the go-a-head English farmers above quoted, and like them he depends mainly on repeated weedings in spring. At this point, however, a suggestion may perhaps be given to the Bengali ryots. The great modern improvement in English corn-farming is in the method of cleaning the stubbles in autumn: corn after corn in olden times

was found always to get the land foul (*i.e.* with twitch, black-grass, &c., the arch-enemies of corn), and the modern experimenters only grow "corn after corn for ever" by laying out labor on the stubbles in autumn. The effective method of doing this is first to cut the field into narrow strips (cands) of about 4 feet broad by a series of double furrows; then a simple scarifier, *i.e.* a flat bar of iron, is drawn so as to shave along two to three inches below the surface of the soil. This operation is performed in the driest autumn weather, when all the fragments of creeping roots thus cut are subsequently "roasted up" by the sun. In this way the biennial and perennial grasses are crushed, and the noxious creeping grasses severely cut-up and destroyed. Some still bolder experimenters, instead of using a scarifier for this purpose, hoe the stubbles by hand, a far more expensive, but very efficacious, process: two men, one stepping close behind the other, proceed along the lands, carrying each a hoe of such breadth that the two will pretty well cover the breadth of the land Many good English farmers, if the plant of turnips fails, nevertheless insist on having the turnips hoed when there are none to hoe.

The effect of all this autumn tilth is that the quantity of noxious weeds that appears among the corn in spring is comparatively small, and the hand-weeding of the young corn is thus reduced within manageable bounds. The suggestionwhich we venture with great humility to the Bengali ryot is that it might be found economical (nothing but actual experiment could decided) to scour the owsh and amon land in the cold weather, say January, with a simple scarifier or hoe in order to lessen the frightful labour of hand-weeding the young rice in the hot weather. We do not suppose that weeds would be exterminated by this or any plan, but we cannot but think that, if the creeping grasses and the cyperaceæ were all cut off at two or three inches beneath the surface of the soil in the clear dry weather of January, they would appear the next spring in less strength among the corn. We may give the caution in passing that the plough would not do for his purpose: the plough will hardly go except after a shower, and then it turns over and buries the creeping weeds, instead of shaving them and leaving them to be roasted up. For short ploughing, as has been said, according to the go-a-head English corn-grower is a barbarous process at all times, and promotes, above all other processes, the growth of weeds. The Bengali plough, as is mentioned below, is, however, more of a cultivator than a plough; and in some districts it is not uncommon to plough the dry rice stubbles in January after the stubble is burnt with the object of diminishing the weeds. We have no doubt but that the simple scarifier (and much more the hoe) proposed would be far preferable for this operation to the plough. In suggesting a hoe or a simple

scarifier, we are suggesting an implement the cost of which is within the means of the ryot. Many of the implements which have been pressed on his attention are utterly beyond his means.

In support of our suggestion, we may quote the fact that the Bengali ryot is aware that the growth of some cold-weather crops, as of mustard, is always followed by a superior rice-crop; the mustard acts as a cleaning crop, both because it admits of easy hoeing, and by choking to a considerable extent the weeds under it. The Bengali rotation of late rice, mustard, and then owsh, is thus exactly parallel to the English rotation of wheat July harvested, then white turnips fed off in February, then barley. This rotation was only practicable in the south of England, where the harvest, being early, a smart man could get his white turnips sown early in August; but it was a favourite venture many years back even with old-fashioned farmers to try to "steal" this crop. And we quote this fact, especially because the success of this rotation clearly shows that the excellence of the barley was not due to any rest the land got (on the Liebig theory), but to the capital autumn tilth the land got from the two or three hoeings bestowed on the turnips. And this is the explanation which we advance of the fact that taking an extra cold-weather crop in Bengal without any manure improves the subsequent crop.

Having made this suggestion for the diminution of the plague of creeping grasses and cyperaceæ, we may confess that we have none to meet the pest of oori. It would doubtless be prudent to abandon its cultivation altogether: it can be but of small value; and then persistent extirpation, as it is an annual, might be expected to be effective in restricting the nuisance within bounds.

The Bengali ryot always attributes any failure in his crop to the water. The owsh depends almost entirely on the abundance of showers in the hot weather. These rarely fail in East Bengal, and the owsh crop, being the least valuable of the three, we rarely hear much whether it is better or worse than usual.

For the amon it is necessary that the water rise steadily, and it is necessary for a good crop that it do not sink away too early. It is very little important whether the water rise a cubic higher or lower than usual: the amon can adapt itself to that, and the loss of a cubit of straw is not worth consideration. But if the water rises a couple of cubits very rapidly, it will swamp and ruin the amon; and if it falls back at all in the middle of the season, the amon gets yellow-stalked, and the yield is spoilt. It is not essential to amon that the water should remain up very late, but it may be assumed that the longer the water remains the better the amon is, both in quantity and quality. During two out of the three years that we have been in Bengal, the amon has been seriously injured by storms of wind after the water which protected

it had sunk away, and before it was ripe. By the storms of the third week of October 1866, and of the first week of November 1867, the amon was blown down in many places, so that the unripe heads of the corn fell into the mud. We are told this is a very frequent cause of partial failure in the amon crop, and we have heard it said that the amon in 1867 was diminished one-fourth by this cause; but we can express no opinion on this estimate.

For the rowa, late rain is essential; it matters little the gross quantity of rain or how short the rain may be before August: the fields are always wet enough for planting out by August. The rowa essentially requires enough rain to keep it moist through September; for a good crop it requires showers throughout October,—if in November also so much the better. In 1865, the rains ceasing early in September, the rowa generally failed; in 1866 and 1867, the rain being continued late, the rowas were excellent; in 1868, there was no rain from 1st October to 30th November, and the rowas were very middling.

The Bengali ryot has little idea of "farming for a bad season;" but we will venture to speculate on some plans by which it might be hoped to meet to some extent irregularities in the water-supply.

The owsh is of least importance; the best support that can be given it to contend with deficiency in water is undoubtedly manure The Bengali ryot usually gives it ashes. And all the manure he has at command is bestowed either on a winter crop or on the owsh, and is rightly so bestowed. The question then arises, can he increase the amount of manure at command? The only practicable plan we see for him would be to tie up his cows and bullocks by day as well as by night. This appears to us not at all likely to be found an improvement. The English advanced farmer keeps his cattle in yards it is true, but this is not done wholly for their manure. It is done partly to shelter the animals from the weather, partly to hasten their fattening; and as to the manure, many of the advanced farmers cart it out on to the very pastures which the beasts might have fed, for it is found that nothing pays better for manuring than pasture. Manure has an unexplained effect in keeping the grass fine. If the village-commons of East Bengal were mown instead of fed, and given no manure, they would soon go down into mere jungle-grass. In short, we believe the manure is much better bestowed on them than on the owsh. We think the owsh must be left to the season.

Next, as to the amon. It is clear that if this crop could be thrown forward a month, it would hardly ever fail We suggested once that it might pay to plant out amon from nurseries at the moment when the field first became flooded.

We found that some Hindu proprietors had suggested the very same thing to their tenants, but we cannot find any example where it has actually been tried. We were told that the ryots only advanced as an objection the labour of transplanting, an altogether insufficient objection. It would no doubt be an operation requiring considerable smartness on the part of the ryot who would have to be watching for the very moment when he could work his field; if he let the moment slip, he would lose the crop altogether. On the other hand, as in rowa, this plan would save much spring-weeding and completely avoid oori. On the whole, we do not believe it is a plan generally practicable, but there are many particular lands were it might be worth a trial.

Lastly as to the rowa, the most valuable part of the rice crop, we see no improvement practicable except a greater promptness in planting it out at the earliest opportunity. As in the case of amon, the harvest would be a certainty if it could be thrown a month forward; but the rowa cannot be transplanted out till the field is thoroughly wet and can be worked down into mud. We do not pretend to think any great revolution of improvement remains to be invented, but we are confident we have seen numberless instances where we have observed the ryot transplanting out three weeks later than he might have done. The Bengali ryot appears to us to assume that the rain *ought* to last through October, and not to wish to take any care to be prepared for the contingency of its ceasing in September. Three years out of four such care would be thrown away, and he would get no better harvest than his supine neighbours, and the Bengali will not undertake any extra exertion to meet the less probable case. But in this exercise of promptness lies nearly the whole secret of practical farming; the seizing of a favorable opportunity, ploughing when the land is just "right," &c. In agriculture opportunities are rarely accorded twice.

To take a particular instance. During the past season, 1868, the rains in Mymensingh were very heavy the last three weeks of June. As regards the rowa lands in which the rowa was not preceded by owsh, we can find no sufficient reason why the rowas might not have been all planted out in July instead of in August. Had this been done, the rain having entirely failed in Mymensingh in October, the crop would have been one month earlier and fifty per cent. better. There would have been little risk in getting in the rowa earlier, for if October had proved wet, it would not have injured it. In the nurseries the rowas could, if necessary, be easily got forward by artificial watering for a month before the rains set in.

The favourite remedy proposed to provide against want of water both for amon and rowa is manure. But whence is the manure to come? As regards amon, too, the crop rarely fails, because the plant is not strong enough. The more frequent cause of failure, as we have seen, is its being laid wholly or partially by storms It is certain that the application of manure would increase the damage from this cause: it is just possible that sowing some salt with the amon might keep it up better, that is at all events found a specific for keeping corn up in England; but we are not aware that the *rationale* thereof has been very satisfactorily explained, and trying it on amon would be only one experiment more. As regards the rowa, we do not think working manure into the liquid mud in which it is planted out is an experiment that promises well, even if, as has been before said, the manure were forthcoming, and not wanted for any other purpose.

Those who have been most earnest to improve Bengali agriculture have pressed specially upon the ryot the use of English ploughs, harrows, and drills, in place of his own weapons.

First, as to ploughs. In preparing for rowa no person could possibly use an English plough. As to the tilth of dry ground the English plough cuts deeper and turns the furrow simply over; the Bengali plough stirs up the surface only after the manner of a cultivator. The advanced English farmer is partial to cultivators, and when he ploughs, he can never get a man to plough fleet enough to please him. It is also objected to the Bengali plough, that it goes slowly, and that its form is badly adapted for making its way through the soil. As to its slowness, that matters little where you plough with a yoke of oxen; as to its form, it must be remembered that a plough which goes easily stirs the ground little; you cannot have mechanical work effected at one end of a machine unless applied at the other. On the whole, the Bengali ryot gets a very fine though shallow tilth for his spring-corn sowing. We doubt whether it can be much improved, and whether the old wooden plough will be superseded in a country without a pebble.

Next, as to the harrow. No English harrow again could be used in a tilth for rowa. As to the dry-weather tilth, it seems to us that the English cast-iron harrow would do better than the Bengali machine, where you can find the fields large enough. This brings us up to the question of Morcellement. There can be no doubt but that the fields in East Bengal are in general far too subdivided for economy of tilling. This is not, however, in East Bengal a consequence of laws of inheritance: the people understand well enough how to share out among co-parceners the rent of an undivided field. But a talookdar

often divides one of his own fields, because he finds that he can let the two pieces for more rent than he can the one undivided field. The same cause operated in Ireland to produce cottier tenantry. The only remedy would appear to be some principle of association among the ryots, by which two or more ryots or even a whole village might rent lands on a limited liability principle. But customs are not easily altered.

Lastly, as to the drill. Even in England, with dear labour and the most perfect drills, it is a question whether dibbling does not pay; in many seasons and on wet lands it certainly does. In East Bengal, rowa must be planted out by hand, and the small fields oppose an insurmountable objection to the use of drills for owsh or amon. We believe that, if broad-cast sowing is superseded, it will be by the larger employment of transplanting rather than of drills.

Having thrown cold water on the suggestion of so many others, we may add that in our opinion the chief direction to look for advance is that by which the steps to the present amount of success have been taken, viz. the continual improvement of varieties of rice, and the careful adaptation of each that is best for particular land. Rowas are very little grown in Furreedpore, Vicrampore, and Manickgunge, because the land is said to be too sandy, not retentive enough. But perhaps some of the inferior rowas now used in parts of Dacca might succeed in these sandy districts, or, if not, some day there may be brought out a hardier variety of rowa which shall thrive even in sandy land. And for the best lands which now produce the finest rowas, yet more fruitful varieties of rowa may possibly be produced by variation under domestication. We doubt if irrigation in East. Bengal will ever be of any general advantage: there is plenty of water; the point is to select such varieties of rice and adopt such plans of husbandry as may untilise best the water as it now comes.

In attacking so boldly Liebig's theories, we must not be understood to mean that soil has nothing to do with the growth of corn; on the contrary, we consider land sound for corn to be essentially required for all corn-growingexperiments. But we doubt whether the agricultural chemists have found out exactly the office of the soil. We suspect its mechanical capacity as a mere retainer of moisture is one of its most important offices both in England and in Bengal. With regard to the general theory of exhaustion, we may state broadly that we have never yet seen an *exhausted clean farm* in England. Many and many a foul farm have we seen which would require two or three years' expensive and judicious "bringing round" before much corn could be got of it.

Neither must we be understood to undervalue manure; but the highest art in farming is to grow continual corn-corps without manure, and that the Bengali ryot succeeds in doing to the confusion of the theorists. And his process is fundamentally identical with that pursued by those irrepressible farmers in England, who will succeed in growing corn after corn without (or with exceedingly little) manure, after Baron Liebig has demonstrated the impossibility of so doing.

It would be quite foreign to the purpose of this article to enter on political questions; but Bengali agriculture and its improvement depend greatly on such considerations. Since the passing of Act X no sane landlord can allow either by lease or occupancy any permanence of tenure to a tenant; and the continual, often annual, change of tenancy is necessarily a great bar to all improvement, especially cold-weather tilth. Another far more fatal bar to improvement is the almost universal custom among landlords of taking extra rent if the crop proves good, not because of anticipation of improved crops in future, but merely because the ryot is "able to pay" more. The landlords assert that this system is benificial to the ryot, because he gets a *corresponding* remisssion in bad seasons, concerning which we have some doubts. The custom is, we presume, entirely illegal. It is needless to expend argument to show that any such custom must in the highest decree tend to render the ryot careless about his crops. Why should he sow that others may reap? Whilst this state of things continues, it is, as it seems to us, unreasonable to abuse the ryot because he is not eager to try every experiment that is suggested to him.

The conclusion, we fear not very practical, which we have reached at present, is that we have not very much to teach the Bengali ryot in the art of farming for rice.

W. M. E.—Reg. No. 13744—100—19-3-79.

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